PATENT SPECIFICATION

794,596

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COMPLETE SPECIFICATION

Lighting Dimmers

We, CENTURY LIGHTING INC., of 521 West 43rd Street, New York 36, New York, United States of America, a Corporation organized under the laws of the State of New York, United States of America, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to dimmers of the type which, for example, is adapted to be employed for theatrical, television and display lighting. More particularly our invention is concerned with mechanical dimmers for spotlights.

It presently is not possible satisfactorily to dim, i.e. reduce the light output of, a conventional spotlight, e.g. a spotlight employing a parabolic reflector, or a Fresnel lens with or without a spherical reflector. In such standard spotlights present-day commmercial dimmers either affect the specific distribution of light radiated by the spotlight at any set focus of the light source, or change the spectral characteristics of the output.

For example, one method of dimming now used is to vary the voltage supplied and thereby change the intensity of the light source. However, this alters the quality of the light causing a change in what is known as "spectral temperature." That is to say as the voltage is reduced the temperature of the incandescent source is lowered whereby to decrease its intensity. But lowering the temperature shifts the spectrum toward the infra red end. This change in spectral temperature is particularly undesirable for color photography and color television and must be taken into account even in black and white reproduction.

The other current method of dimming is to reduce the periphery of an opening through which a light beam passes. For this there is employed a standard shutter, such as an iris shutter or a "barn door" shutter, i.e. a shutter having blades swinging about axes lying in a plane perpendicular to the axis of propagation of the beam. Both shutters make the spot of light smaller as the opening of the shutter decreases and the barn door shutter has the further disadvantage that it shapes the spot of light into a polygon.

Thus in both methods some characteristic of the light in addition to its intensity is effected. In the first case the spectral temperature is varied and in the other case the distribution of light.

It is an object of the present invention to provide a dimmer of the character described which will vary the intensity of a spotlight without noticeably affecting any of its other characteristics.

It is another object of our invention to provide a dimmer of the character described which is rugged, compact, and efficient and is relatively inexpensive to manufacture.

Other objects of our invention will in part be obvious and in part will be pointed out hereinafter.

In general we provide a dimmer of the character described whose construction is such that it removes portions of the spotlight beam in a substantially symmetrical fashion and as nearly as possible from all parts of the beam at the same time. In other words parts are removed from the outside of the beam as well as from the central part and at a number of different points about the axis at the same time, the intensity of the light source being left constant. With this arrangement the apparent distribution or shape of the light in the beam, and therefore illumination of an object on which the beam is trained, will remain unchanged and only the intensity of the beam will seem to vary.

In its broadest aspect the invention comprises a lighting dimmer comprising a support having an aperture therein, and a plurality of elongated shutter members each of which is pivotally mounted at one end on the support and is normally located in an inoperative position in which it extends along the periphery of the aperture, the shutter members being located at spaced intervals on the sup-

[*Price 3s. 6d.*]

port around the aperture, wherein means is provided for moving the shutter members from their inoperative position to operative positions in which the other ends of each pair of adjacent members extend inwardly of the aperture and in which the members are spaced apart from one another along their lengths, the widths of the members when in their inoperative position being less than the intervals whereby as the members initially are moved towards their operative position there are spaces present between each pair of adjacent members, and wherein means is also provided for increasing the width of the shutter members so as to reduce the space between each pair of adjacent members.

In the accompanying drawings in which is shown one of the various possible embodiments of our invention,

Figure 1 is a front view of a fully open dimmer constructed in accordance with our invention and with portions of the cover plate removed to better illustrate the internal construction;

Figure 2 is a side view of the dimmer;

Figs. 3, 4, 5 and 6, are enlarged sectional views taken substantially along the lines 3—3, 4—4, 5—5, and 6—6, respectively, of Fig. 1.

Fig. 7 is a front view of the dimmer with the cover plate removed and the handle moved about one-sixth of the way to closed position;

Figs. 8 and 9 are views similar to Fig. 7 but with the handle moved about one-third and five-eighths of the way, respectively, to closed position;

Fig. 10 is a view similar to Fig. 7 but with the dimmer fully closed; and

Fig. 11 is an enlarged view of one of the shutter members in fully closed position.

Referring now in detail to the drawings, and more particularly to Figs. 1—6, the reference numeral 20 denotes a dimmer constructed in accordance with our invention. Said dimmer consists of a pair of apertured supports, such as a base ring 22 and aligned cover plate 24, which are held in parallel spaced relationship by a plurality of pivot posts 26 equiangularly disposed around the peripheries of the ring and plate. The ring and plate have large central registered apertures A. One end of each post is permanently secured as by swedging in the base ring. The other end of each post terminates beneath the cover plate and is provided with a tapped bore 28 in which the shank of a bolt 30 is screwed. Each bolt extends through an opening 32 in the cover plate and its head is located on the outer surface of said plate. All the pivot posts are equiradially located with respect to the center of the ring and plate.

A drive ring 34 is sandwiched between the base ring and cover plate, the circumference of the drive ring being journalled on the posts 26 which jointly function as a bearing. The large central aperture in the drive ring is coincident with those in the base ring and cover plate.

The dimmer further includes a plurality of long flat shutter-members or blades 36 substantially parallel to the base ring. Each blade consists of a long thin flat segment 38 and a short thin flat segment 40, the segments being pivotally secured to one another at their tips as by a flush rivet 42. The segments of each blade taper in width from their broad bases to their narrow tips and are of about the same contour so that when superimposed they are substantially coextensive except for the protruding base of the longer segment. The protruding base of each long segment is formed with a pivot bearing 44 which is journalled on the pivot post 26. Each short segment has a pin 46 mounted on its base and journalled in an opening 48 in the drive ring. The openings 48 are equiangularly disposed in the drive ring. It will be observed that the pins 46 are closer to the center of the dimmer aperture than the bearings 44.

In the preferred form of our invention alternate blades 36 are disposed on opposite sides of the drive ring and are held flat against said ring by the base ring and cover plate.

Suitable means is included to rotate the drive ring relative to the base ring and cover plate. As shown herein, said means comprises a stud 50 fixed to the drive ring and extending through an arcuate slot 52 in the inner periphery of the cover plate. Said slot serves to limit the angular motion of the stud. A handle 54 is secured to the outer end of the stud, said handle being slotted, as at 56, to facilitate actuation thereof. When the stud is in the position illustrated in Fig. 1 the dimmer is fully open, i.e. the blades 36 are substantially at or outside the dimmer aperture. Movement of the shutter to the opposite end of the slot 52 fully closes the dimmer.

The relative positions of the bearing 44 and pin 46 and the use of two segments for each blade are important features of our invention. As will be seen in Fig. 1, when the stud 50 is in fully open position the segments are substantially coextensive, the blades are at the peripheries of the apertures A and the pin 46 of each blade is approximately on the radial line R running from the center of the shutter to the associated bearing 44. In the preferred form of our invention each pin 46 lies slightly to one side of the associated line R—the side opposite to that on which said pin is disposed when the blade is in fully closed position. In other words in the preferred form of out invention each pin 46 crosses the associated radial line R from the bearing to the center of the dimmer as the pin moves from open to closed position or vice-versa.

Due to this arrangement of the parts, as the stud and drive ring initially are moved from open towards closed position, the two segments of each blade will swing almost

jointly about the associated bearing 44, with the tips of the segments swinging inwardly toward the center of the dimmer. Such initial, i.e. early, movement of the segments is shown in Fig. 7 at which time each pin 46 has barely crossed the associated radial line R while the stud 50 has been moved over about one-sixth of its total travel from open to closed position.

It may be mentioned that as each blade moves from its Fig. 1 to its Fig. 7 position the short segment 40 will rotate in a clockwise direction, as viewed in Fig. 10, relative to the long segment 38 about the rivet 42 until it is radially in line with the bearing 44. After the rivet 42 crosses the associated radial line R the short segment 40 will move in a counterclockwise direction relative to the long segment 38, as viewed in Fig. 10. However, the initial relative movement of the segments 38, 40 about the rivet 42 is very slight because in the open position of the dimmer the rivet 42 lies close to said radial line R. Accordingly, for a substantial arc of movement of the drive ring 34 and blade 36, the segments 38, 40 will experience very little relative movement. This is quite clearly demonstrated by comparing the location of the blades in the open position of the dimmer shown in Fig. 1, with the location of the blades illustrated in Fig. 7 and the location of said blades illustrated in Fig. 8. In this last position the stud has shifted approximately one-third of its entire movement to fully closed position. It will be seen that the blades have moved a substantial distance towards the center of the shutter and yet the segments still are in almost their original relative position wherein they were substantially coextensive. Indeed, until the stud has shifted over approximately one-half of its entire permissible arc of motion, the blades remain substantially coextensive.

When the stud has shifted over approximately two thirds of its permissible arc of motion the segments occupy the position shown in Fig. 9. At this time the tips of the blades are almost at the center of the dimmer aperture but by now the angular movement of the rivet 42 relative to the center of the dimmer has carried well past the radial line R of the associated bearing 44 so that the segment 40 has begun to experience a substantial movement with respect to the segment 38 about the rivet 42. Due to this movement the blade as a whole broadens from its tip toward its base. In other words the segments of each blade fan out although still overlapping.

When the stud is in fully closed position the blades are in the relative locations shown in Fig. 10 wherein the tips of the blades are juxtaposed close to the center of the dimmer aperture and the segments have fanned out to an extent such that the segments of each blade barely overlap one another. In this position the blades are wide enough for the edges of one blade to overlie or underlie the juxtaposed edges of the two adjacent blades so that all passage of light through the dimmer between the blades is blocked. Inasmuch as contact of the tips of the blades as they approach the center of the dimmer aperture prevent the center of said aperture from being completely covered, in order to prevent all passage of light through the dimmer, one of the blades is provided with a disk 58 so disposed that when the blades are in fully closed position the disk overlies the aperture defined by the tips of the blades.

From the foregoing it will be seen that over approximately the first half of the movement of the stud the blades swing inwardly substantially in the manner of the blades of an ordinary iris shutter except that the blades do not overlie one another so that spaces in the shapes of spiral spokes are left between the blades for the passage of light. Thus in this first half cycle of operation of the dimmer not only is light being blocked from the periphery of the dimmer aperture but also light progressively is being blocked toward the center of the aperture. Is other words, during the first half of the cycle the segments of each blade swing jointly or substantially jointly toward the center of the aperture.

Motion of the stud during the second half of the closing cycle swings the blades further toward the center of the aperture but such motion is comparatively slight. The major action of the blades during the second half of the cycle is a fanning out motion of the segments, i.e. a widening of the blades to fill out the spiral spoke-like spaces between adjacent blades. This latter motion substantially uniformly reduces the aperture from the center to the periphery thereof.

It thus will be apparent that our new construction fulfills the principal function necessary for an efficient dimmer, that is, it removes portions of the spotlight beam in a substantially symmetrical fashion from substantially all parts of the beam at the same time, i.e. from the outside of the beam as well as the central portion of the beam and from a number of different points about the axis of the beam at the same time without in any way interfering with the intensity of the light source.

It is clear that reverse movement of the stud from closed to open position initially will swing the segments towards one another into substantial registration while they experience a slight swinging movement outwardly about the bearing 44. During the second half of the movement of the stud toward open position the principal motion of the segments will be a joint swinging about the bearing 44 although at the same time they will experience a comparatively slight relative movement about the rivet 42.

It thus will be seen that we have provided a device which achieves all the objects of our invention and is well adapted to meet the conditions of practical use.

As various possible embodiments might be made of the above invention, and as various changes might be made in the embodiment above set forth, it is to be understood that all matter herein described, or shown in the accompanying drawings, is to be interpreted as illustrative and not in a limiting sense.

What we claim is:—

1. A lighting dimmer comprising a support having an aperture therein, and a plurality of elongated shutter members each of which is pivotally mounted at one end on the support and is normally located in an inoperative position in which it extends along the periphery of the aperture, the shutter members being located at spaced intervals on the support around the aperture, wherein means is provided for moving the shutter members from their inoperative position to operative positions in which the other ends of each pair of adjacent members extend inwardly of the aperture and in which the members are spaced apart from one another along their lengths, the widths of the members when in their inoperative position being less than the intervals whereby as the members initially are moved towards their operative position there are spaces present between each pair of adjacent members, and wherein means is also provided for increasing the width of the shutter members so as to reduce the space between each pair of adjacent members.

2. A lighting dimmer as claimed in Claim 1, wherein each shutter member has a base portion and a tip, each member tapering from its base to its tip and being pivotally mounted on the support at its base portion.

3. A lighting dimmer as claimed in Claim 2, wherein the width of each shutter member is expansible about its tip and the distance between the pivotal mountings of adjacent members exceeds the unexpanded widths of the bases of the members.

4. A lighting dimmer as claimed in Claim 3, wherein the width of the members is expansible by the means for moving the members from their inoperative positions, whereby the progressive pivotal movement of the members inwardly of the aperture progressively increases the width of the members about their tips to block off the spaces between the members and thereby eventually close the aperture.

5. A lighting dimmer as claimed in any one of the preceding claims, wherein each shutter member comprises a plurality of overlapping elongated segments, each of which tapers towards the tip of the segment.

6. A lighting dimmer as claimed in Claim 5, wherein the segments of the shutter member are pivotally secured to one another adjacent their tips and the base portions of the segments are movable relatively to each other to vary the width of the members.

7. A lighting dimmer as claimed in Claim 6, wherein the base portion of one segment is pivotally connected to the support and the base portion of the other segment is pivotally connected to operating means for moving the shutter members from their inoperative position.

8. A lighting dimmer as claimed in any one of the preceding Claims 5 to 7, wherein the segments of each shutter member are substantially co-extensive in the inoperative position of the member.

9. A lighting dimmer as claimed in any one of the preceding Claims 5 to 8, wherein one segment is mounted on a base ring forming a support and another segment is mounted on a drive ring mounted co-axially of the base ring for rotation relatively thereto.

10. A lighting dimmer as claimed in Claim 9, wherein the segment connected to the base ring is longer than the segment connected to the drive ring.

11. A lighting dimmer as claimed in any one of Claims 3 to 10, wherein during the movement of the shutter member from open to closed position of the dimmer, the members first move to positions in which their tips are adjacent the centre of the aperture, and subsequently the members expand.

12. A lighting dimmer as claimed in Claim 11, as appendant to Claim 10, wherein the pivotal mountings of the segments on the drive and base rings are located substantially on the same radial line from the centre of the device when the shutter members are in their inoperative position.

13. A lighting dimmer as claimed in Claim 12, wherein the pivotal mounting of the segment to the drive ring is located, in the inoperative position of the segments, closely adjacent the radial line through the pivotal mounting of the other segment with the base ring, but on that side of the line which is remote from its location in operative positions of the device.

14. A lighting dimmer substantially as described and as shown in the accompanying drawings.

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Fig. 1.

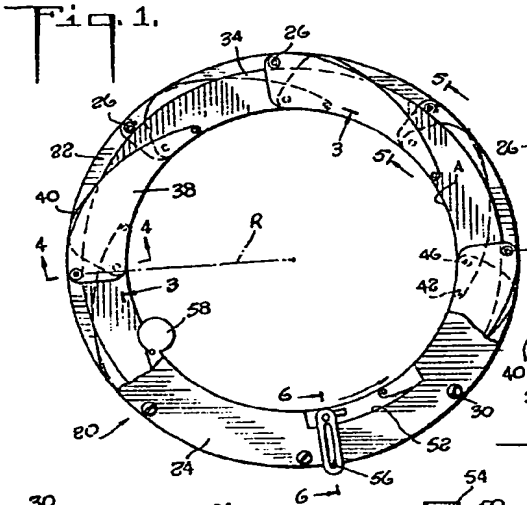


Fig. 4.

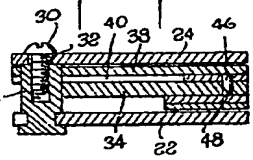


Fig. 5.

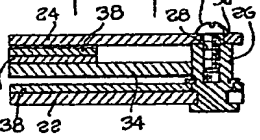


Fig. 2.

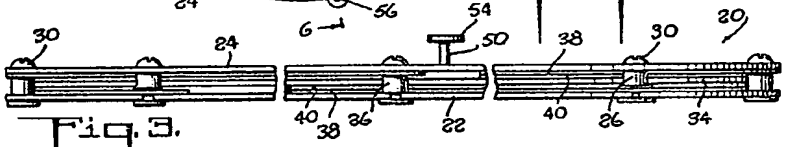


Fig. 3.

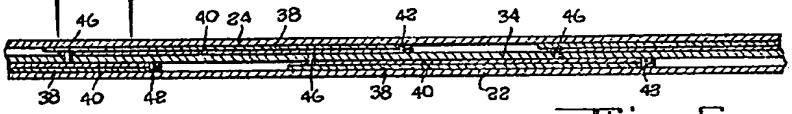


Fig. 11.

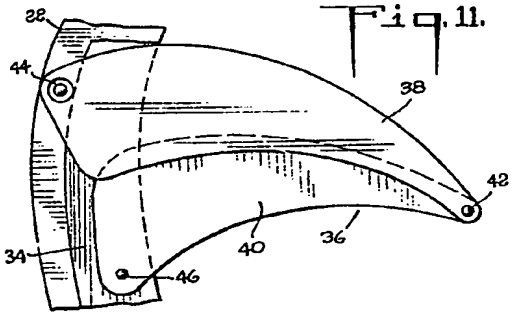
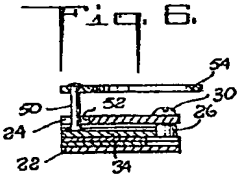


Fig. 6.



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2 SHEETS

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SHEETS 1 & 2

Fig. 7.

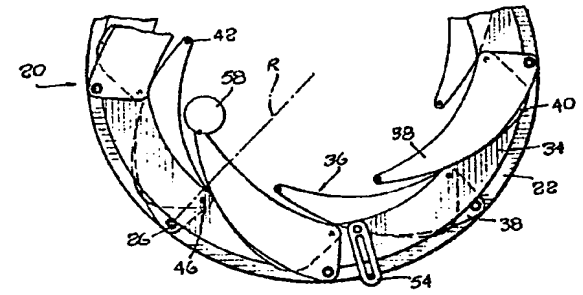


Fig. 8.

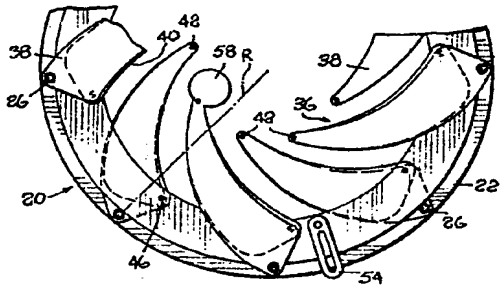


Fig. 9

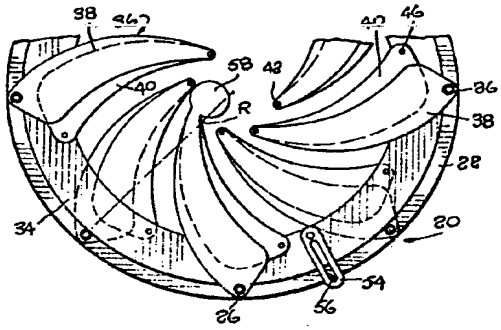
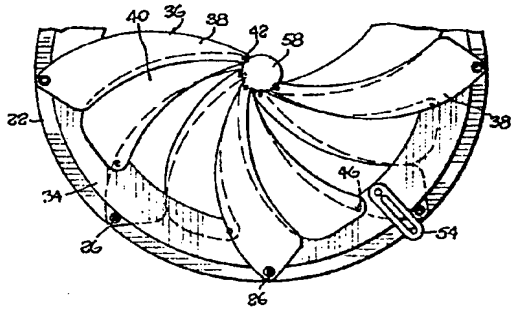


Fig. 10.



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SHEETS 1 & 2